

## CLAIMS

1. A CVD process for forming a thin film, comprising:  
a vaporizing step of heating and vaporizing an  
5 organometallic compound to yield a source gas;  
a thin film forming step of introducing said source gas  
onto a substrate and allowing the source gas to react on a  
surface of the substrate to yield a thin film of a metal or  
metal oxide;  
10 a recovering step of cooling an exhaust gas containing  
a reaction product formed in said thin film forming step and  
an unreacted source gas to condense or solidify said  
unreacted source gas to thereby yield a recovered content  
containing a liquid or solid organometallic compound; and  
15 a purifying step of separating and purifying the  
organometallic compound from said recovered content.

2. A CVD process for forming a thin film according to  
claim 1, further comprising a step of eliminating oxygen  
20 from the exhaust gas prior to the recovering step.

3. A CVD process for forming a thin film according to  
claim 1 or claim 2, wherein said recovering step is  
performed by cooling the exhaust gas with a cold trap and  
25 wherein oxygen has been eliminated from said cold trap.

4. A CVD process for forming a thin film according to

any one of claims 1 to 3, wherein said purifying step comprises a step of distilling the recovered content to thereby separate the organometallic compound.

5           5. A CVD process for forming a thin film according to any one of claims 1 to 4, wherein said purifying step comprises a step of bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

10           6. A CVD process for forming a thin film according to claim 5, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between  
15 the recovered content and the solvent.

20           7. A CVD process for forming a thin film according to claim 5 or claim 6, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor  
25 solvent.

8. A CVD process for forming a thin film according to

claim 7, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

5

9. A CVD process for forming a thin film comprising:  
a vaporizing step of heating and vaporizing an organometallic compound to yield a source gas;

10 a thin-film-forming step of introducing said source gas onto a substrate and allowing the source gas to react on a surface of the substrate to yield a thin film of a metal or metal oxide;

15 a recovering step of bringing an exhaust gas containing a reaction product formed in said thin-film-forming step and an unreacted source gas into contact with a solvent in which the organometallic compound is soluble to dissolve the organometallic compound in the solvent to thereby recover the organometallic compound; and

20 a purifying step of separating and purifying the organometallic compound from the solvent containing the organometallic compound.

10. A CVD process for forming a thin film according to claim 9, further comprising a step of eliminating oxygen  
25 from the exhaust gas prior to the recovering step.

11. A CVD process for forming a thin film according to

claim 9 or claim 10, wherein said recovering step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the exhaust gas and the solvent.

5

12. A CVD process for forming a thin film according to any one of claims 9 to 11, wherein said purifying step comprises one of a step of cooling the solvent to thereby separate the organometallic compound in a solid state and a  
10 step of bringing the solvent into contact with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

13. A CVD process for forming a thin film according to claim 12, wherein said purifying step further comprises a  
15 step of heating the solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

20

14. A CVD process for forming a thin film according to any one of claims 9 to 11, wherein said purifying step comprises a step of subjecting the solvent containing the organometallic compound to liquid chromatography.

25

15. A CVD process for forming a thin film according to claim 14, wherein a filler used in the liquid chromatograph

is one selected from the group consisting of silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

5        16. A CVD process for forming a thin film, comprising:  
a vaporizing step of heating and vaporizing an organometallic compound to yield a source gas;

10        a thin-film-forming step of introducing said source gas onto a substrate and allowing the source gas to react on a surface of the substrate to yield a thin film of a metal or metal oxide;

15        a recovering step of bringing an exhaust gas containing a reaction product formed in said thin film forming step and an unreacted source gas into contact with an adsorbent to adsorb the organometallic compound to thereby recover the organometallic compound; and

20        a purifying step of separating and purifying the organometallic compound from the adsorbent adsorbing the organometallic compound.

25        17. A CVD process for forming a thin film according to claim 16, further comprising a step of eliminating oxygen from the exhaust gas prior to the recovering step.

30        18. A CVD process for forming a thin film according to claim 16 or claim 17, wherein an activated carbon is used as the adsorbent.

19. A CVD process for forming a thin film according to claim 16 or claim 17, wherein a host compound capable of including the organometallic compound as a guest is used as  
5 the adsorbent.

20. A CVD process for forming a thin film according to any one of claims 16 to 19, wherein said purifying step comprises a step of heating the adsorbent adsorbing the  
10 organometallic compound to thereby separate the organometallic compound.

21. A CVD process for forming a thin film according to claim 20, wherein said purifying step further comprises a  
15 step of subjecting the separated organometallic compound to gas chromatography.

22. A CVD process for forming a thin film according to claim 21, wherein a filler used in the gas chromatograph is  
20 one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

23. A CVD apparatus for producing a thin film  
25 comprising a container for accommodating an organometallic compound as a material, a heating means for heating the solution to thereby vaporize the organometallic compound to

yield a source gas, and a reactor for allowing said source gas to react to thereby form a thin film of a metal or metal oxide on a substrate,

wherein said apparatus further comprises, on the downstream side from the reactor, a recovering means for obtaining a recovered content containing the organometallic compound from an exhaust gas, said exhaust gas being composed of a reaction product formed through a reaction and an unreacted source gas, and a purifying means for separating and purifying the organometallic compound from said recovered content.

24. A CVD apparatus for producing a thin film according to claim 23, further comprising, between the reactor and the recovering means, an oxygen eliminating means for eliminating oxygen from the exhaust gas.

25. A CVD apparatus for producing a thin film according to claim 23 or claim 24, wherein said recovering means is a cold trap in which the exhaust gas is cooled to yield the recovered content in a liquid state.

26. A CVD apparatus for producing a thin film according to claim 23 or claim 24, wherein said recovering means is a solvent tank for containing a solvent in which the organometallic compound is soluble.

27. A CVD apparatus for producing a thin film according to claim 23 or claim 24, wherein said recovering means is an adsorption tank filled with an adsorbent capable of adsorbing the organometallic compound.



What is claimed is:

1. A CVD process for forming a thin film, comprising:  
a vaporizing step of heating and vaporizing an  
5 organometallic compound to yield a source gas;

a thin film forming step of introducing said source gas  
onto a substrate and allowing the source gas to react on a  
surface of the substrate to yield a thin film of a metal or  
metal oxide;

10 a recovering step of cooling an exhaust gas containing  
a reaction product formed in said thin film forming step and  
an unreacted source gas to condense or solidify said  
unreacted source gas to thereby yield a recovered content  
containing a liquid or solid organometallic compound; and  
15 a purifying step of separating and purifying the  
organometallic compound from said recovered content.

2. A CVD process for forming a thin film according to  
claim 1, further comprising a step of eliminating oxygen  
20 from the exhaust gas prior to the recovering step.

3. A CVD process for forming a thin film according to  
claim 1, wherein said recovering step is performed by  
cooling the exhaust gas with a cold trap and wherein oxygen  
25 has been eliminated from said cold trap.

4. A CVD process for forming a thin film according to

claim 2, wherein said recovering step is performed by cooling the exhaust gas with a cold trap and wherein oxygen has been eliminated from said cold trap.

5           5. A CVD process for forming a thin film according to claim 1, wherein said purifying step comprises a step of distilling the recovered content to thereby separate the organometallic compound.

10           6. A CVD process for forming a thin film according to claim 2, wherein said purifying step comprises a step of distilling the recovered content to thereby separate the organometallic compound.

15           7. A CVD process for forming a thin film according to claim 3, wherein said purifying step comprises a step of distilling the recovered content to thereby separate the organometallic compound.

20           8. A CVD process for forming a thin film according to claim 4, wherein said purifying step comprises a step of distilling the recovered content to thereby separate the organometallic compound.

25           9. A CVD process for forming a thin film according to claim 1, wherein said purifying step comprises a step of bringing the recovered content into contact with a solvent

in which the organometallic compound is soluble.

10. A CVD process for forming a thin film according to claim 2, wherein said purifying step comprises a step of  
5 bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

11. A CVD process for forming a thin film according to claim 3, wherein said purifying step comprises a step of  
10 bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

12. A CVD process for forming a thin film according to claim 4, wherein said purifying step comprises a step of  
15 bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

13. A CVD process for forming a thin film according to claim 5, wherein said purifying step comprises a step of  
20 bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

14. A CVD process for forming a thin film according to claim 6, wherein said purifying step comprises a step of  
25 bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

15. A CVD process for forming a thin film according to claim 7, wherein said purifying step comprises a step of bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

5

16. A CVD process for forming a thin film according to claim 8, wherein said purifying step comprises a step of bringing the recovered content into contact with a solvent in which the organometallic compound is soluble.

10

17. A CVD process for forming a thin film according to claim 9, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the recovered content and the solvent.

15

18. A CVD process for forming a thin film according to claim 10, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the recovered content and the solvent.

20

19. A CVD process for forming a thin film according to claim 11, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the recovered content and the solvent.

25

20. A CVD process for forming a thin film according to claim 12, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between  
5 the recovered content and the solvent.

21. A CVD process for forming a thin film according to claim 13, wherein said purifying step comprises a step of eliminating oxygen from the solvent in which the  
10 organometallic compound is soluble prior to contact between the recovered content and the solvent.

22. A CVD process for forming a thin film according to claim 14, wherein said purifying step comprises a step of  
15 eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the recovered content and the solvent.

23. A CVD process for forming a thin film according to claim 15, wherein said purifying step comprises a step of  
20 eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the recovered content and the solvent.

24. A CVD process for forming a thin film according to claim 16, wherein said purifying step comprises a step of  
25 eliminating oxygen from the solvent in which the

organometallic compound is soluble prior to contact between the recovered content and the solvent.

25. A CVD process for forming a thin film according to  
5 claim 9, wherein said purifying step comprises one of a step  
of cooling a solvent containing the recovered content to  
thereby separate the organometallic compound in a solid  
state, and a step of mixing a solvent containing the  
recovered content with a poor solvent to thereby separate  
10 the organometallic compound in a solid state, the  
organometallic compound being sparingly soluble in said poor  
solvent.

26. A CVD process for forming a thin film according to  
15 claim 10, wherein said purifying step comprises one of a  
step of cooling a solvent containing the recovered content  
to thereby separate the organometallic compound in a solid  
state, and a step of mixing a solvent containing the  
recovered content with a poor solvent to thereby separate  
20 the organometallic compound in a solid state, the  
organometallic compound being sparingly soluble in said poor  
solvent.

27. A CVD process for forming a thin film according to  
25 claim 11, wherein said purifying step comprises one of a  
step of cooling a solvent containing the recovered content  
to thereby separate the organometallic compound in a solid

state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

28. A CVD process for forming a thin film according to claim 12, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

29. A CVD process for forming a thin film according to claim 13, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

30. A CVD process for forming a thin film according to

claim 14, wherein said purifying step comprises one of a  
step of cooling a solvent containing the recovered content  
to thereby separate the organometallic compound in a solid  
state, and a step of mixing a solvent containing the  
5 recovered content with a poor solvent to thereby separate  
the organometallic compound in a solid state, the  
organometallic compound being sparingly soluble in said poor  
solvent.

10 31. A CVD process for forming a thin film according to  
claim 15, wherein said purifying step comprises one of a  
step of cooling a solvent containing the recovered content  
to thereby separate the organometallic compound in a solid  
state, and a step of mixing a solvent containing the  
15 recovered content with a poor solvent to thereby separate  
the organometallic compound in a solid state, the  
organometallic compound being sparingly soluble in said poor  
solvent.

20 32. A CVD process for forming a thin film according to  
claim 16, wherein said purifying step comprises one of a  
step of cooling a solvent containing the recovered content  
to thereby separate the organometallic compound in a solid  
state, and a step of mixing a solvent containing the  
25 recovered content with a poor solvent to thereby separate  
the organometallic compound in a solid state, the  
organometallic compound being sparingly soluble in said poor



solvent.

33. A CVD process for forming a thin film according to claim 17, wherein said purifying step comprises one of a  
5 step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the  
10 organometallic compound being sparingly soluble in said poor solvent.

34. A CVD process for forming a thin film according to claim 18, wherein said purifying step comprises one of a  
15 step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the  
20 organometallic compound being sparingly soluble in said poor solvent.

35. A CVD process for forming a thin film according to claim 19, wherein said purifying step comprises one of a  
25 step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the

recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

5

36. A CVD process for forming a thin film according to claim 20, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

10

15

37. A CVD process for forming a thin film according to claim 21, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

20

25

38. A CVD process for forming a thin film according to claim 22, wherein said purifying step comprises one of a

step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate  
5 the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

39. A CVD process for forming a thin film according to  
10 claim 23, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate  
15 the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

40. A CVD process for forming a thin film according to  
20 claim 24, wherein said purifying step comprises one of a step of cooling a solvent containing the recovered content to thereby separate the organometallic compound in a solid state, and a step of mixing a solvent containing the recovered content with a poor solvent to thereby separate  
25 the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

41. A CVD process for forming a thin film according to claim 25, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

42. A CVD process for forming a thin film according to claim 26, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

43. A CVD process for forming a thin film according to claim 27, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

44. A CVD process for forming a thin film according to claim 28, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

45. A CVD process for forming a thin film according to claim 29, wherein said purifying step further comprises a

step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

5           46. A CVD process for forming a thin film according to claim 30, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

10           47. A CVD process for forming a thin film according to claim 31, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and  
15 the reaction product.

          48. A CVD process for forming a thin film according to claim 32, wherein said purifying step further comprises a step of heating the separated solid organometallic compound  
20 to thereby sublime one of the organometallic compound and the reaction product.

          49. A CVD process for forming a thin film according to claim 33, wherein said purifying step further comprises a  
25 step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

50. A CVD process for forming a thin film according to claim 34, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

51. A CVD process for forming a thin film according to claim 35, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

52. A CVD process for forming a thin film according to claim 36, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

53. A CVD process for forming a thin film according to claim 37, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

54. A CVD process for forming a thin film according to claim 38, wherein said purifying step further comprises a

step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

5            55. A CVD process for forming a thin film according to claim 39, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

10            56. A CVD process for forming a thin film according to claim 40, wherein said purifying step further comprises a step of heating the separated solid organometallic compound to thereby sublime one of the organometallic compound and  
15 the reaction product.

            57. A CVD process for forming a thin film comprising:  
a vaporizing step of heating and vaporizing an organometallic compound to yield a source gas;

20            a thin-film-forming step of introducing said source gas onto a substrate and allowing the source gas to react on a surface of the substrate to yield a thin film of a metal or metal oxide;

            a recovering step of bringing an exhaust gas containing  
25 a reaction product formed in said thin-film-forming step and an unreacted source gas into contact with a solvent in which the organometallic compound is soluble to dissolve the

organometallic compound in the solvent to thereby recover the organometallic compound; and

5 a purifying step of separating and purifying the organometallic compound from the solvent containing the organometallic compound.

58. A CVD process for forming a thin film according to claim 57, further comprising a step of eliminating oxygen from the exhaust gas prior to the recovering step.

10

59. A CVD process for forming a thin film according to claim 57, wherein said recovering step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the exhaust gas and the solvent.

15

60. A CVD process for forming a thin film according to claim 58, wherein said recovering step comprises a step of eliminating oxygen from the solvent in which the organometallic compound is soluble prior to contact between the exhaust gas and the solvent.

20

61. A CVD process for forming a thin film according to claim 57, wherein said purifying step comprises one of a step of cooling the solvent to thereby separate the organometallic compound in a solid state and a step of bringing the solvent into contact with a poor solvent to

25



thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

5           62. A CVD process for forming a thin film according to claim 58, wherein said purifying step comprises one of a step of cooling the solvent to thereby separate the organometallic compound in a solid state and a step of bringing the solvent into contact with a poor solvent to  
10           thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

          63. A CVD process for forming a thin film according to  
15           claim 59, wherein said purifying step comprises one of a step of cooling the solvent to thereby separate the organometallic compound in a solid state and a step of bringing the solvent into contact with a poor solvent to thereby separate the organometallic compound in a solid  
20           state, the organometallic compound being sparingly soluble in said poor solvent.

          64. A CVD process for forming a thin film according to claim 60, wherein said purifying step comprises one of a  
25           step of cooling the solvent to thereby separate the organometallic compound in a solid state and a step of bringing the solvent into contact with a poor solvent to

thereby separate the organometallic compound in a solid state, the organometallic compound being sparingly soluble in said poor solvent.

5           65. A CVD process for forming a thin film according to claim 61, wherein said purifying step further comprises a step of heating the solid organometallic compound to thereby sublime one of the organometallic compound and the reaction product.

10           66. A CVD process for forming a thin film according to claim 62, wherein said purifying step further comprises a step of heating the solid organometallic compound to thereby sublime one of the organometallic compound and the  
15 reaction product.

20           67. A CVD process for forming a thin film according to claim 63, wherein said purifying step further comprises a step of heating the solid organometallic compound to thereby sublime one of the organometallic compound and the  
reaction product.

25           68. A CVD process for forming a thin film according to claim 64, wherein said purifying step further comprises a step of heating the solid organometallic compound to thereby sublime one of the organometallic compound and the  
reaction product.

69. A CVD process for forming a thin film according to claim 57, wherein said purifying step comprises a step of subjecting the solvent containing the organometallic  
5 compound to liquid chromatography.

70. A CVD process for forming a thin film according to claim 58, wherein said purifying step comprises a step of subjecting the solvent containing the organometallic  
10 compound to liquid chromatography.

71. A CVD process for forming a thin film according to claim 59, wherein said purifying step comprises a step of subjecting the solvent containing the organometallic  
15 compound to liquid chromatography.

72. A CVD process for forming a thin film according to claim 60, wherein said purifying step comprises a step of subjecting the solvent containing the organometallic  
20 compound to liquid chromatography.

73. A CVD process for forming a thin film according to claim 69, wherein a filler used in the liquid chromatograph is one selected from the group consisting of silica gel,  
25 octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

74. A CVD process for forming a thin film according to claim 70, wherein a filler used in the liquid chromatograph is one selected from the group consisting of silica gel, octadecylsilane, alumina, porous polymers, graphite carbon,  
5 and zeolite.

75. A CVD process for forming a thin film according to claim 71, wherein a filler used in the liquid chromatograph is one selected from the group consisting of silica gel,  
10 octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

76. A CVD process for forming a thin film according to claim 72, wherein a filler used in the liquid chromatograph  
15 is one selected from the group consisting of silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

77. A CVD process for forming a thin film, comprising:  
20 a vaporizing step of heating and vaporizing an organometallic compound to yield a source gas;

a thin-film-forming step of introducing said source gas onto a substrate and allowing the source gas to react on a surface of the substrate to yield a thin film of a metal or  
25 metal oxide;

a recovering step of bringing an exhaust gas containing a reaction product formed in said thin film forming step and

an unreacted source gas into contact with an adsorbent to adsorb the organometallic compound to thereby recover the organometallic compound; and

5 a purifying step of separating and purifying the organometallic compound from the adsorbent adsorbing the organometallic compound.

10 78. A CVD process for forming a thin film according to claim 77, further comprising a step of eliminating oxygen from the exhaust gas prior to the recovering step.

15 79. A CVD process for forming a thin film according to claim 77, wherein an activated carbon is used as the adsorbent.

80. A CVD process for forming a thin film according to claim 78, wherein an activated carbon is used as the adsorbent.

20 81. A CVD process for forming a thin film according to claim 77, wherein a host compound capable of including the organometallic compound as a guest is used as the adsorbent.

25 82. A CVD process for forming a thin film according to claim 78, wherein a host compound capable of including the organometallic compound as a guest is used as the adsorbent.

83. A CVD process for forming a thin film according to claim 77, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

84. A CVD process for forming a thin film according to claim 78, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

85. A CVD process for forming a thin film according to claim 79, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

86. A CVD process for forming a thin film according to claim 80, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

87. A CVD process for forming a thin film according to claim 81, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

88. A CVD process for forming a thin film according to

claim 82, wherein said purifying step comprises a step of heating the adsorbent adsorbing the organometallic compound to thereby separate the organometallic compound.

5            89. A CVD process for forming a thin film according to claim 83, wherein said purifying step further comprises a step of subjecting the separated organometallic compound to gas chromatography.

10           90. A CVD process for forming a thin film according to claim 84, wherein said purifying step further comprises a step of subjecting the separated organometallic compound to gas chromatography.

15           91. A CVD process for forming a thin film according to claim 85, wherein said purifying step further comprises a step of subjecting the separated organometallic compound to gas chromatography.

20           92. A CVD process for forming a thin film according to claim 86, wherein said purifying step further comprises a step of subjecting the separated organometallic compound to gas chromatography.

25           93. A CVD process for forming a thin film according to claim 87, wherein said purifying step further comprises a step of subjecting the separated organometallic compound to

gas chromatography.

94. A CVD process for forming a thin film according to claim 88, wherein said purifying step further comprises a  
5 step of subjecting the separated organometallic compound to gas chromatography.

95. A CVD process for forming a thin film according to claim 89, wherein a filler used in the gas chromatograph is  
10 one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

96. A CVD process for forming a thin film according to claim 90, wherein a filler used in the gas chromatograph is  
15 one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

97. A CVD process for forming a thin film according to claim 91, wherein a filler used in the gas chromatograph is  
20 one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

25

98. A CVD process for forming a thin film according to claim 92, wherein a filler used in the gas chromatograph is



one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

5            99. A CVD process for forming a thin film according to claim 93, wherein a filler used in the gas chromatograph is one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers, graphite carbon, and zeolite.

10            100. A CVD process for forming a thin film according to claim 94, wherein a filler used in the gas chromatograph is one selected from the group consisting of siloxanes, silica gel, octadecylsilane, alumina, porous polymers,  
15            graphite carbon, and zeolite.

             101. A CVD apparatus for producing a thin film comprising a container for accommodating an organometallic compound as a material, a heating means for heating the  
20            solution to thereby vaporize the organometallic compound to yield a source gas, and a reactor for allowing said source gas to react to thereby form a thin film of a metal or metal oxide on a substrate,

             wherein said apparatus further comprises, on the  
25            downstream side from the reactor, a recovering means for obtaining a recovered content containing the organometallic compound from an exhaust gas, said exhaust gas being

composed of a reaction product formed through a reaction and an unreacted source gas, and a purifying means for separating and purifying the organometallic compound from said recovered content.

5

102. A CVD apparatus for producing a thin film according to claim 101, further comprising, between the reactor and the recovering means, an oxygen eliminating means for eliminating oxygen from the exhaust gas.

10

103. A CVD apparatus for producing a thin film according to claim 101, wherein said recovering means is a cold trap in which the exhaust gas is cooled to yield the recovered content in a liquid state.

15

104. A CVD apparatus for producing a thin film according to claim 102, wherein said recovering means is a cold trap in which the exhaust gas is cooled to yield the recovered content in a liquid state.

20

105. A CVD apparatus for producing a thin film according to claim 101, wherein said recovering means is a solvent tank for containing a solvent in which the organometallic compound is soluble.

25

106. A CVD apparatus for producing a thin film according to claim 102, wherein said recovering means is a

solvent tank for containing a solvent in which the organometallic compound is soluble.

107. A CVD apparatus for producing a thin film  
5 according to claim 101, wherein said recovering means is an adsorption tank filled with an adsorbent capable of adsorbing the organometallic compound.

108. A CVD apparatus for producing a thin film  
10 according to claim 102, wherein said recovering means is an adsorption tank filled with an adsorbent capable of adsorbing the organometallic compound.